REPORT

OF

THE INTERNATIONAL WORKSHOP

ON

"NATIONAL ISSUES ON COMPUTERS IN EDUCATION"

HELD AT THE

INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY, INDIA

16th – 18th MARCH 1987

JOINTLY SPONSORED BY :

TECHNICAL COMMITTEE 3, INTERNATIONAL FEDERATION OF INFORMATION PROCESSING (TC-3, IFIP)

COMPUTER SOCIETY OF INDIA (CSI)

INDIAN INSTITUTE OF TECHNOLOGY, BOMBAY (IIT BOMBAY)

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CONTENTS

Sr.No.	Item		Page
1.	Workshop Programme	....	1
2.	Workshop Report	....	3
3.	"Conclusions and Recommendations" in Summary	....	6
4.	Appendix 1 : Session Details, panel members session-wise 'Conclusions and Recommendations'	....	8
5.	Appendix 2 : Organising Committees, sponsors	....	28
6.	Appendix 3 : List of Workshop participants with addresses	....	30

WORKSHOP PROGRAMME

"NATIONAL ISSUES ON COMPUTERS IN EDUCATION"

Dates : March 16-19, 1987

Venue : Guest House Conference Hall,
Indian Indian of Technology,
Powai, Bombay 400 076 (India)

Organizers : Technical Committee - 3 (Education), International Federation of Information Processing (TC-3, IFIP)

Computer Society of India (CSI)

Indian Institute of Technology, Bombay (IIT- B)

Day 1 : March 16, 1987 (Monday)

9.00 AM Registration

9.30 AM Inaugural Session

Introductory Remarks : Prof. B. Nag, Chairman,
Organising Committee

Maj.Gen. A. Balasubramanian
IFIP (India Rep.)

Keynote Addresses : Prof. W. Brauer, Chairman, TC-3, IFIP

Prof. H.N. Mahabala, President
Computer Society of India.

11.15 AM Invited Talk : Prof. Ashoka Chandra, Educational Adviser (T)
Ministry of Human Resource Development, New Delhi
'Indian National Viewpoint on Policies in Computer Education'

11.45 AM General Discussion on Conduct of Workshop : Prof. J.R. Isaac , Programme Coordinator,
Outline of Workshop Procedure and Objectives.

2.00 PM Workshop Technical Sessions*
5.30 PM

Day 2 : March 17, 1987 (Tuesday)

9.00 AM Workshop Technical Sessions*
6.00 PM

Day 3 : March 18, 1987 (Wednesday)

9.00 AM Workshop Technical Session*

12.15 PM

[NB : *Session titles and panels given in Appendix-I]

1.30 PM Summary/Concluding Session - Chairman : Prof.W.Brauer
6.00 PM

Day 4 : March 19, 1987 (Thursday)

Visit to the Tata Institute of Fundamental Research (TIFR), Computer Maintenance Corporation(CMC) at Nehru Centre, Tata Consultancy Services (TCS) and National Centre for Software Technology (NCST).

Workshop Rapporteurs :
1. Prof. DVR Vithal, Osmania University, Hyderabad
2. Dr. S.C. Mehta, Dept. of Electronics, New Delhi
3. Mr. S.D. Sherlekar, Dept. of CS & E, IIT Bombay

WORKSHOP REPORT

"NATIONAL ISSUES ON COMPUTERS IN EDUCATION"

Bombay, India.

16-18 March, 1987

PREAMBLE

In order to explore the emerging area of computers in education, a three-day Workshop was organised by the Technical Committee 3 (TC-3) of the International Federation of Information Processing (IFIP), the Computer Society of India (CSI) and the Indian Institute of Technology, Bombay, from March 16th, 1987 to March 18th, 1987 at IIT-Bombay. The aim of the Workshop was to produce a **'Working Document'**, which would contain specific conclusions and recommendations on the effective exploitation of computers in education. The Workshop would not be directly concerned with Computer Science education per se, but be concerned with more general aspects of computer science and informatics in the broader context of all education. This was due to the fact that sufficient emphasis had been given to 'learning about computers', while the concept of 'learning with computers' in which the computer, with all its power and flexibility, is merely a tool in the process of problem-solving, had been almost totally neglected despite its very crucial role in all educational activities.

[NB : With due deference to the heterogeneous backgrounds of the Workshop Participants from the world over and their respective perceptions; the words/phrases such as Computers/Computer Science/Informatics/etc., have been used as synonyms, and the reader may substitute the more meaningful/relevant/comprehensive term as per his/her own perceptions].

INTRODUCTION

Sixty participants from twenty-three countries convened to discuss problems related to effectively integrating computers into education. While there was general agreement that all countries are struggling with similar problems, the conclusions and recommendations which follow could be of special significance to educational decision makers in the developing world, as computers can be particularly effective in the task of transforming human resources into powerful components towards progress through training and education.

The use of the computer is all pervading - it reaches out to all disciplines, especially in secondary and tertiary education. This report focuses on the computer as a tool, not on the computer as a subject of study (or informatics).

It was agreed that the computer is a tool which can be a vehicle for economic, social and educational improvement. But this will only happen with national long-term commitment. This commitment must take the form of sufficient funding levels for long-term as well as short-term projects, careful planning and coordination, and especially major support for professional training - which, all agree, is the number one priority. While historically there has been an emphasis on the acquisition of hardware and software, the major problem now facing all nations is a lack of adequately trained teachers. Unless we are able to solve this problem, we will never realize the tremendous potential which the computer provides for giving teachers a tool to improve the quality of education.

We believe that this is a long-term problem that has no simple solution. It is necessary that each country develop its own strategy for best adopting or adapting these 'Conclusions and Recommendations' to its own local environment and situation. There is a universal need for better models, evaluation studies and long range planning in every country, as well as continued cooperation between countries. It is our hope that this report will aid all countries in tacking these very important and difficult problems and issues.

Conduct of the Workshop :

In order to sharply focus on specific issues and themes, and to have in-depth discussions, the Workshop was conducted in ten sessions; followed by a concluding session. Each session was led by a panel of specialists followed by detailed discussions. Each session Chairman submitted the 'Conclusions and Recommendations' of his particular session, and at the final concluding session these were considered by all participants in detail. It was left to a 'Final Draft Sub-Committee' to draw up the Workshop Report in its final form, based on the closing deliberations.

For a general overview of the Workshop deliberations, the ten issues and theme sessions may be considered under four general section headings :-

Section A : The Potential of Informatics in Education
Section B : Computers in Primary, Secondary and Tertiary Education
Section C: Computers in Continuous, Vocational, In-Service, Non-Formal and Distance Education
Section D: Computers in Special Education

SESSION DETAILS

As stated earlier, the Workshop consisted of ten theme and issue sessions which focussed attention on specific topics. The detailed 'Conclusions and Recommendations' drawn up by each of these session panels are given in Appendix-1. These conclusions and recommendations are reproduced as submitted by the panel Chairmen. Though there may appear to be overlaps between some sessions, the exact context of the session must be taken into account.

In the context of the four sub-divisions stated earlier, the sessions may be broadly classified as below :-

Section A : The Potential of Informatics in Education (Theme Session)
Section B : Computers in Primary, Secondary and Tertiary Education

Session B1 : National Policies in Primary, Secondary and Tertiary Education
Session B2 : Computer-based-education : Planning, Tools and Infrastructures
Session B3 : Problems of Implementing Computer-based-education
Session B4 : Course Modules for Non-Computer Science Students at Tertiary level
Session B5 : Training Teachers for Informatics

Section C : Computers in Continuing, Vocational, In-Service, Non-formal and Distance Education.

Session C1 : Computers in Vocational, In-Service and Continuing Education
Session C2 : Computers in Distance Education
Session C3 : Computers in Non-Formal Education, including Rural and Adult Education

Section D : Computers in Special Education

Session D1 : Computers in Education of the Handicapped
Session D2 : The Development of Non-English Based Computer Systems for Education.

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CONCLUSIONS AND RECOMMENDATIONS OF THE WORKSHOP - IN SUMMARY

Details of the ten theme and issue sessions, the panelists, and the 'Conclusions and Recommendations' drawn by each session are given in Appendix I. However, the major 'CONCLUSIONS AND RECOMMENDATIONS' of the Workshop are summarized below for the benefit of educationists and educational planners at the National level.

I

* 'Learning-with-Computers' offers a very powerful tool for educators, and all efforts must be made to harness the potential of computers and informatics in education. Further, this technology enforces a deeper appreciation of educational pedagogy.

II

* Unless backed by well-planned short and long term projects at the National level, the full potential of this educational technology cannot be exploited. Financial considerations of hardware/software costs should be subservient to educational objectives.

III

* The all-pervasive nature of computers/informatics enforces awareness and literacy programmes, and the exploitation of computer-based technologies in both formal and non-formal educational sectors.

IV

* Computers and informatics should play a supportive role in all educational areas, and the basic principles and methodologies of algorithmic and systems-oriented thinking should be inculcated into traditional/new teaching systems in all disciplines and areas of learning and teaching.

V

* The computer's versatility makes it an ideal tool for special education requirements, such as educational aids for the handicapped and for the mentally retarded. Also, computers can offer multilingual support facilities, widening the sphere of effectiveness into rural areas and breaking down cultural barriers.

VI

* Computer-based-education offers excellent scope for exploiting the 'multiplier-effect' of good teachers, and also can be an effective tool in distance educational systems. This educational technology could therefore have a more encompassing role to play in the developing world.

VII

* The key towards exploiting computer-based technologies lies in effective teacher training. Teachers have to be trained to :-

(a) Accept and adopt computer/informatics-oriented techniques and methodologies into their own teaching, and/or

(b) Teach relevant computer science topics and techniques to make students more competent in their own disciplines.

VIII

* Computer-based national and regional educational testing and information services should be set-up to support educational planning and implementation efforts.

APPENDIX I

SECTION A : THE POTENTIAL OF INFORMATICS IN EDUCATION

Theme Session

Panel : Prof. W. Brauer, Prof. V. Rajaraman, Mr. Peter Bollerslev, Prof.J.R. Choudhury

Preamble

Computer Science should be seen as a discipline of thinking, rather than a subject in the curriculum. This discipline should be integrated in the teaching of all subjects and at all levels.

Conclusions and Recommendations

C1 : The rationale for the overall integration of computer science with education is the role of computers seen in the context of the environment in which we live. Besides opening new ways of thinking, this new tool is a possible vehicle for economic and social improvement.

R1.1 : It should be recognized that computer science and the application of computers form an essential part of all disciplines, and educational policies should take cognizance of this.

C2 : As computer science is all pervading, it is essential in a national policy to specify the priorities, based on the needs and socio-economic considerations.

C3 : There are deeper implications of computer science in education at all levels and in all fields, thus changes ought to take place over a period. Each nation has to determine the levels and fields and also the time-frame for the integration of computer science, based on their national priorities.

R3.1 : As this field is very broad and will require a large commitment of resources, it is essential in formulating policies to set priorities, based on needs and the socio-economic considerations.

C4 : There is a requirement to continuously train teachers in all disciplines in computer science so that they can effectively integrate computer science in the teaching of their own disciplines.

C5 : Computers are a supplementary aid to the teacher in the teaching process, they cannot be a substitute.

R5.1 : Teachers in all disciplines are to be enabled to integrate computer science in the teaching of their own disciplines.

C6 : The introduction of computer science in education is a slow process and thus requires a long term commitment.

R6.1 : As the integration of computer science in education is a slow process, it is essential to commit resources over a long period.

C7 : Appropriate application of computers requires continuous education.

R7.1 : As computer science is a continuously evolving discipline, teachers and professionals are to be continuously educated on the appropriate applications of computers.

C = Conclusions

R = Recommendations

APPENDIX I

SECTION B: COMPUTERS IN PRIMARY, SECONDARY AND TERTIARY EDUCATION

Session B1 : National Policies in Primary, Secondary and Tertiary Education

Panel : Ms. Sandra Wills, Prof.A.K. Jalaludhin, Prof. Todor Boyanov

Preamble

Computers can have an important role to play in primary, secondary and tertiary education as a tool to improve the teaching and learning process. At secondary and tertiary level the computer is often also an object of study.

All countries have been experimenting with computers in education for a number of years and now many countries have national computer education policies built on the feedback from previous activities and projects. Even countries, that do not expect to allocate funds to computer education yet, are developing policies. Policies are a statement of : 1. Why computers might be used (from the political, economic, social, technological and educational perspectives)? 2. What the usage of computers can achieve, given the current resource commitment? 3. How the country intends to go about it? and 4. How the current policy can be evaluated and improved? The word 'teachers' is used in the generic sense to mean educators at all levels.

Conclusions and Recommendations

R1 : National policies should address professional development as the highest priority with excellence as the objective.

R2 : Since professional development is inherently a slow process, adequate time frame must be allowed for in the policy.

R3 : As the technology is rapidly changing in the field, it is necessary for the professional development of teachers to stress the techniques more than the technology. Professional development needs to be on a continuing basis.

R4 : In the development of national policies the consensus and classroom experience of practising educators should be sought. Other representatives of the education community including parents, should also be involved.

R5 : National policies should continually be reviewed in the light of feedback and evaluation from classroom teachers and students.

R6 : Computers in education should be viewed holistically so that the impact on all levels and all subjects is considered simultaneously, though current national priorities may determine major focus on one area at a time. The policy should be built to current or future general educational policies.

R7 : Effort must be made to explore the diverse ways of employing computers to promote new and alternative teaching methodologies. Research should also consider the impact that computer techniques have on changing traditional curriculum content and traditional content boundaries.

R8 : Decisions on ways of using computers in education often reinforce current educational, social, and economic inequities amongst students and amongst teachers. Conscious effort therefore has to be made to counteract such situations.

R9 : In view of rapid obsolescence in this field, it is essential that investments are allocated on a continuing basis for updating systems and software.

R10 : Computers in education cannot be tackled in isolation. It must have the full support of the total infrastructure so that for example professional development is not wasted by being in conflict with administrative procedures or curriculum restrictions,etc.

R11 : The development of national policies benefits from international co-operation in the exchange of information and experience, and therefore should be continued.

APPENDIX I

SECTION B : COMPUTERS IN PRIMARY, SECONDARY AND TERTIARY EDUCATION

Session B2 : Computer Based Education : Planning, Tools and Infrastructures

Panel : Prof. R. Morel, Prof. P. Palchowdhury, Dr. Suresh Wani

Preamble

Traditional educational systems include class-room teaching and distance education in a variety of set-ups. Both formal and non-formal teaching can benefit from the use of computers. The following conclusions were drawn and recommendations made:

Conclusions and Recommendations

C1 : Computers can improve and enrich traditional teaching if courseware/software is adequately designed, developed, evaluated and integrated into teaching and training along with other audio/video techniques.

R1.1 : Design teams should develop adequate models of learning with the help of educational psychologists, subject specialists and experienced teachers.

R1.2 : All computer-based models and teaching aids must be field tested, evaluated and continuously improved.

R1.3 : All teams producing software/courseware should include specialists in graphics, animation and programming. In some cases, gifted school children can be encouraged to contribute to the production.

C2 : Careful planning and evaluation are necessary for any new application of computers on a large scale to education. CAL and CBT tools for relevant topics are to be indigenously developed and tailor-made keeping in view the local requirements. In order to be effective, adequate number of multi-disciplinary CBT packages are required for the teachers.

R2.1: Before computers become a household commonplace, a study of their impact on children should be conducted and the findings made known to the public.

R2.2 : Hardware and software with CAL/CBT features should be provided to teachers engaged in the development and use of CBT.

R2.3 : Teachers should be trained in the use and selection of CAL/CBT.

R2.4 : Development of CAL/CBT courseware should be carried out with teachers in the concerned subject playing the nodal role.

R2.5 : In view of the large magnitude of effort needed in the development of CAL/CBT courseware for different subjects, regional resource centres should be set up.

R2.6 : R and D in the field of CAL/CBT should be supported.

R2.7 : International cooperation in the development and use of CBT material is essential. International bodies like IFIP and UNESCO have to play a leading role in this respect.

C3 : Schools impart three kinds of knowledge : important skills (eg. arithmetic composition), enriching experiences (eg. arts, literature, music) and conceptual material. The use of the algorithmic approach and other appropriate concepts of informatics should be a common aspect of imparting knowledge at all levels.

R3.1 : The algorithmic approach and systems approach should be used as a component in the teaching of all subjects.

R3.2 : School teachers should be exposed to the analysis and design of algorithms and other concepts of informatics as rapidly as possibly so that these approaches could be introduced in the teaching of traditional subjects.

C4 : A minimum quantity of computer resources is necessary for any perceptible impact on teaching.

R4.1 : There are various ways for setting up computer equipment in schools:

a. Computer-rooms intended for use of a whole school should have number of terminals not less than a quarter of the number of pupils in a typical class. Also, an adequate number of peripherals should be included.

b. Integration of computer usage within frontal teaching requires a teacher's work station with adequate large-screen display.

c. School libraries and laboratories should have available one/several work-stations.

d. The set-up should be selected according to the methodologies and the activities planned for.

e. Connecting all school equipment to a local area network, with its advantages and draw backs has to be considered and adequate decisions taken in due time.

R4.2 : The inequality arising due to shortage of resources must be tolerated as a temporary phenomenon, and as a better alternative to sub-threshold investment.

R4.3 : When first introducing computers in schools, it is suggested to give priority to secondary education, before the younger ages.

C5 : A major effort has to be invested for pre-service and in-service training of all members of teaching staff that will be involved in applying informatics in their teaching. This conclusion applies to schools and tertiary institutes as well and especially to teachers' training institutes. It is a basic condition for effective implementation of computer-aided-learning.

R5.1 : The actual investment needed has to be well ascertained, but probably it is of the order of magnitude of the investment for hardware.

R5.2 : The training should include basic, initial learning and continuing updating afterwards.

R5.3 : More advanced training, for specific tasks (eg. computer co-ordinators) should be included in the training programmes.

R5.4 : The training plans should include principals, supervisors and other educational and administrative staff.

R5.5 : Computer curriculae should be introduced in teacher training institutes. Necessary hardware and software should be provided.

APPENDIX I

SECTION B : COMPUTERS IN PRIMARY, SECONDARY AND TERTIARY EDUCATION

Session B3 : Problems in Implementing Computer-Based-Education

Panel : Dr. Ben-Zion Barta, Prof. H.V. Sahasrabudhe, Dr. P.K. Patwardhan

Preable

Traditional educational systems include class-room teaching and distance education in a variety of forms. Both formal and non-formal teaching can benefit from the use of computers. The following conclusions were drawn and recommendations made :

Conclusions and Recommendations

C1 : Computers can improve and enrich traditional teaching if courseware/software is adequately designed, developed, evaluated and implemented.

R1.1 : Design teams should develop adequate models of learning with the help of educational psychologists, subject specialists and experienced teachers.

R1.2 : All computer-based models and teaching aids must be field tested, evaluated and continuously improved.

R1.3 : All teams producing software/courseware should include specialists in graphics, animation and programming. In many cases, gifted school-children can be encouraged to contribute to the production.

C2 : Careful planning and evaluation are necessary for any new applications of computers on a large scale in education.

R2.1 : Before computers become a household commonplace, a study of their impact on children should be conducted and the findings made known to the public.

C3 : Schools impart three kinds of knowledge : important skills (eg. arithmetic, composition), enriching experiences (eg. arts, literature, music) and conceptual material. A common aspect of these is the use of the algorithmic approach.

R3.1 : The algorithmic approach and systems approach should be used as components of the teaching methodology.

R3.2 : School teachers should be exposed to the analysis and design of algorithms and the concept of informatics as rapidly as possible, so that the language of algorithms is used in the teaching of traditional subjects.

C4 : A minimum quantity of computer resources is necessary for any perceptible impact on teaching.

R4.1 : Ideally there should be at least one terminal/work station per four students in a class, with all classes time-sharing the system facilities.

R4.2 : The inequality arising due to implementation of 4.1 (in the light of resource shortage) must be tolerated as a temporary phenomenon and as a better alternative to sub-threshold investment.

R4.3 : Secondary education must be accorded priority for the introduction of computers in schools.

R4.4 : No specific recommendation can abe made on the relative merits of a central system or a local area network, as specific environmental factors and operational needs must be taken into account.

APPENDIX I

SECTION B : COMPUTERS IN PRIMARY, SECONDARY AND TERTIARY EDUCATION

Session B4 : Course Modules for non-Computer Science students at Tertiary Level

Panel : Prof. Robert Aiken, Dr. Douglas S.L. Tung, Prof. J.R. Isaac

Preamble

It is necessary to have at least one introductory course for non-computer science majors at the tertiary level. This course will be composed of various modules that are tailored for the end user and emphasize applications rather than any programming language.

Conclusions and Recommendations

C1 : For the present, computers or informatics need to be included into the curriculum/ syllabus at the University level for non-computer science disciplines. This should be done in a modular fashion.

R1.1 : Course content must be identified in a systematic modular manner depending upon specific requirements of the end user.

R1.2 : The student must be given a full awareness of programming methodologies and the use of packages relevant to his discipline.

C2 : Hands-on-experience must form an integral part of the process of instruction.

R2.1 : Students must be exposed to a wide range of hands-on-experience on word processors, database systems, graphics systems and other such utilities.

R2.2 : Assignments need to include both individual and group projects.

R2.3 : Assignments must be based on discipline-specific problems.

C3 : It is essential that subject-matter specialists be involved in the design and delivery of the course material.

R3.1 : In offering such a course, computer scientists need to utilise the expertise of subject experts, eg. team teaching is one possible approach.

R3.2 : Subject-matter specialists must be involved with the design of laboratory and project work of such a course.

R3.3 : As cross-discipline aspects are involved, due attention and care should be taken in offering teacher re-training. Such training should be offered in a phased manner.

APPENDIX I

SECTION B : COMPUTERS IN PRIMARY, SECONDARY AND TERTIARY EDUCATION

Session B5 : Training Teachers for Informatics

Panel : Prof. A. Bagchi, Prof. D. Schubert, Dr. S.R. Thakore

Preamble

Teachers are needed for exploiting the new educational opportunities opened-up by the information revolution. How do we ensure that there is an adequate supply of trained teachers for teaching computer courses?

Conclusions & Recommendations

C1 : There is a worldwide shortage of teachers in informatics, particularly in developing countries.

C2 : Rapid developments in the computer field call for the training and retraining of teachers on a continuing basis to ensure that they are able to keep abreast with current technology.

R2.1 : Adequate emphasis should be placed on the training and retraining of teachers on a continuing basis.

R2.2 : Appropriate curricula should be developed for the training of teachers at different levels.

C3 : Competent and qualified persons in related disciplines like electronics, mathematics, physics and statistics could be more readily retrained to teach computer courses.

R3.1 : Schemes should be drawn up to retrain competent and qualified persons in related disciplines so that they can teach computer courses.

R3.2 : The non-governmental sector and professional societies should be encouraged to contribute to the teacher training process.

R3.3 : Necessary hardware and software should be made available for teacher training activities.

APPENDIX I

SECTION C : COMPUTERS IN CONTINUING, VOCATIONAL, IN-SERVICE, NON-FORMAL AND DISTANCE EDUCATION

Session C1 : Computers in Vocational, In-Service and Continuing Education (VOICE)

Panel : Dr.P.P. Gupta, Mr. B.V. Chitnis, Mr. R.S. Pawar, Dr. A.S. Induruwa, Ms.Angela Goh

Conclusions and Recommendations

C1 : The need for VOICE is three-fold :

(a) Vocational education or training imparts 'job-oriented' education to people so that they can be directly productive.

(b) Continuing and in-service education ensures that obsolescence will not occur among employed professionals.

(c) Unemployed science graduates (in several developing countries) can be re-trained in information technology (IT) to provide them with employment avenues.

C2 : The problems are :

(a) Requirement of good quality software geared towards the end-user and suitable to local cultural conditions.

(b) Requirement of manpower to develop the required software.

(c) Requirement of sufficient hardware for VOICE programs to be sufficiently meaningful.

(d) In the light of the proliferation of small computer coaching classes, the need for standardization in terms of syllabi and examinations.

(e) Tendency to look upon VOICE courses as 'inferior'.

(f) Necessity of spending time on VOICE programs by busy employed professionals.

R1 : Since the corporate sector is the main beneficiary of VOICE (at least in the long run) it is proposed that

(a) a large part of the funding come from this sector

(b) companies show commitment to release personnel for participation in VOICE programs not necessarily restricted to part-time, weekend or after-office hours courses.

R2 : The Government must encourage corporate sector participation in VOICE by providing appropriate incentives such as tax benefits and import duty exemption.

R3 : VOICE courses be accorded 'due respect'. To ensure this, the development of syllabi be taken up by the Government through various established educational institutions both Government and corporate. Also standardized examinations are to be conducted by Computer Societies, professional bodies or other appropriate agencies.

R4 : Since the software development for computer based education is a complex task, experts in education and the field in question must work together. Various professionals societies and agencies, both national and international, must initiate such interaction through symposia/workshops/joint projects.

R5 : It is stressed that most, if not all, educational software be developed indigeneously. However, rather than re-invent the wheel, it would be advisable to review work done in other countries with a view to using those parts (directly or indirectly) that are relevant. Collaboration with 'culturally similar' countries can be considered. An institute should be set up to train people to develop educational software. Alternatively, Resource Centres affiliated to existing established educational institutions, both Goverment and corporate, be asked to develop such software.

APPENDIX I

SECTION C : COMPUTERS IN CONTINUING, VOCATIONAL, IN-SERVICE, NON-FORMAL AND DISTANCE EDUCATION

Session C2 : Computers in Distance Education/Open University System

Panel : Dr. G. Kovacs, Dr. M.M. Pant, Dr. S. Ramani

Preamble

Distance learning system and Open University system have a very wide and significant scope, especially in the developing countries with scarce resource, in areas of densely populated urban areas as well as in sparsely populated remote areas. They can fulfil the needs of those to whom the formal channels of education are not easily or readily accessible, thereby reducing inequities in the present distribution of educational resources. They are particularly helpful to the handicapped and the economically weaker and socially backward sections of society.

Conclusions and Recommendations

R1 : There is need for international cooperation in exchanging experiences, courseware and the technologies. The proposed working group (WG 3.6) of IFIP TC-3 could enable the possibility or international cooperation in distance learning technology and Open University system.

R2 : Conscious efforts are to be made to ensure that the quality and standards of education and evaluation through the Open University system are comparable with those of the traditional University system.

R3 : Realisation of the above objectives would require inter-alia

(a) use of the latest technologies for mass storage of information and efficient procedures of its organisation and its retrieval.

(b) training of resource persons to handle training through the use of such technologies

(c) special thrust in development of software and courseware particularly adapted to local and cultural considerations.

(d) use of modern computer based testing systems for evaluation of student achievements.

(e) giving adequate attention to the applications of artificial intelligence technology in education, particularly in the Open University and distance education system.

R4 : Importance should be given to the continuing education programmes being conducted by professional societies and institutions in the overall context of distance/open education system. Methods of accredition, recognition and other modes of participation be considered.

APPENDIX I

SECTION C : COMPUTERS IN CONTINUING, VOCATIONAL, IN-SERVICE, NON-FORMAL AND DISTANCE EDUCATION

Session C3 : Computers in non-formal Education, including Rural and Adult Education

Panel : Prof. P.V.S. Rao, Prof. S.C. Bhatnagar, Ms. Anjali Sangvikar

Preamble

For countries with large populations and resource constraints, non-formal education can play a significant role in meeting the educational aspirations of the masses. The computer has the potential to have a significant 'multiplier effect' in terms of good teaching methods, computer-based applications and the use of advanced media technologies. Since the benefits of formal education are only available for a small percentage of the population, non-formal education assumes vital importance. The scope and potential, therefore, needs to be explored and the role computers would play in such a system needs to be identified.

Conclusions and Recommendations

Cl : The role of computers in rural areas can be seen as two fold :

(a) rural development program management

(b) CBL for adult literacy and CBT for functional literacy.

R1.1 : Extensive training on computers is necessary for administrators, clerical and other staff to enable them to implement rural development programs successfully. Rural Development Centres situated in rural areas should be supported to conduct training and experiments in using computers for the benefit of rural populations.

R1.2 : Use of local language, access to personal microcomputers, illustrative examples from rural development programs are essential components of such learning/training programs.

C2 : The potential of computers for making the learning/training process more effective is immense. Computers are to be used along with other aids such as video/TV/radio. There is no place for dichotomy of rural/urban in regard to relevance of use of computers in education/training.

R2.1 : Select schools/centres to use CBL more extensively. Their experience will benefit usage in other schools.

R2.2 : The computer as a vehicle for education must be continually experimented with. The hardware/software and management problems must be understood so that when the resources are available, their immediate use is possible.

R2.3 : A long term commitment is essential to implement computer awareness, computer literacy and computer-based-learning in the rural areas.

APPENDIX I

SECTION D : COMPUTERS IN SPECIAL EDUCATION

Session D1 : Computers in the Education of the Handicapped

Panel : Prof. P.V.S. Rao, Prof. S.C. Bhatnagar, Ms. Anjali Sangvikar

Preamble

Typical paraplegia and physically handicapped could form valuable human resource inputs for imparting computer education. They are not handicapped as far as receiving computer education is concerned. On the contrary, they have an inherent advantage for iterative types of jobs.

Conclusions and Recommendations

C1 : Computers are specially effective in the education/training of the handicapped as they offer several specialized and appropriate input-outputs devices. Computer training can help them in obtaining gainful employment and in becoming useful citizens. Computers can help the handicapped in acquiring different skills.

R1.1 : High costs and non-availability of computers and supporting equipment for the handicapped inhibit their wide use. The Government must grant concessions for the acquisition of such systems and view it as a necessary social investment. Exchange of information between Technology Development Groups may enable several industries in developing countries to undertake manufacturing of these equipments, so that equipments will be available at low costs.

R1.2 : There should be commitment to experiment and take projects for the handicapped through pilot projects to be implemented by appropriate agencies. It should be recognised that voluntary/professional organisations can play a key role and should be encouraged and funded.

APPENDIX I

SECTION D : COMPUTERS IN SPECIAL EDUCATION

Session D2 : The Development of non-English based computer systems for education

Panel : Dr.PVHML Narasimhan, Mr.T. Nonaka, Dr. N. Reddy

Preamble

Capability to input/output and process local/regional languages is essential for informatics to be utilized in Educational Systems.

Conclusions and Recommendations

C1 : Capability to input/output and process local/regional languages is available at various stages of development. This must be standardised for informatics to be utilized in educational systems.

R1.1 : The techniques employed for different languages should be reviewed to evolve a common scheme of coding and using standard devices.

R1.2 : Govt./Regulatory bodies may be addressed to enforce and promote the standards thus established.

C2 : For the Chinese, Japanese and other Asian scripts multiple versions exist. These may be reviewed in the context of advanced technology solutions.

R2.1 : The professional societies and regulatory bodies should take part in exchange of information/documentation so that standard/compatible codes are evolved and implemented.

C3 : Phonetic based coding and keying could be adopted for full spectrum of applications in Information Technology, viz., Computer I/O and storage, communications and type-setting.

R3.1 : The documentation/reports of national standards may be examined for their correctness and completness for different languages.

C4 : In addition to providing devices for input/output of regional languages, generic software for word processing, text formating, sorting, authoring support etc., are essential for widespread use of CBL.

R4.1 : Generic software packages are to be developed by teams comprising computer scientists and linguists/educational psychologists.

APPENDIX-2

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